

important factor: the industry's unique input requirements. The real estate industry and the finance and insurance industry each lowered their costs by 3.1% and 2.5% respectively in 1991 because they were more capable of substituting telecommunications for costlier alternative inputs than any other industry over this time frame. Fabricated metals, wholesale and retail trade, and transportation and warehousing rank high in cost savings because they consume telecommunications intensively relative to most industries. Although lumber and wood producers do not consume large amounts of telecommunications services or substitute them for other inputs in a particularly extensive manner, they perform well because their input requirements include large expenditures on fabricated metals and wholesale and retail trade (see *Table III-1-I*). Thus, lumber and wood producers benefit from lower input prices made possible by telecommunications-induced cost savings in the fabricated metals and wholesale and retail trade industries. Similarly, the amusements industry ranks high in cost savings because it spends heavily on real estate and business services.

The 1.2% reduction in production costs helped to forestall further escalation of Arkansas's price level and lower overall prices in the Arkansas economy. In 1991, this translated into a reduction in the state's CPI by 1.4% compared with the level it would have attained had telecommunications technology not advanced since 1977.

The lower cost of living benefited the entire Arkansas economy--both businesses and consumers. Employees benefited because inflation-adjusted (real) wages were higher, and consumers benefited because both inflation-adjusted and nominal income was higher. Businesses benefited because inflation-adjusted input costs (wages and materials) were lower.

III-2. Telecommunications-Induced Efficiency Gains

Employment

Reductions in Arkansas business costs following from telecommunications usage in Arkansas since 1977 has generated an average of approximately 4,800 jobs per year from 1977 through 1991. In 1991, Arkansas employed almost 11,000 more people than it would have if constrained to 1977 telecommunications technology. This represents about 1.2% of the state's total employment in 1991. These 4,800 jobs represent about 4 times the employment of the Arkansas petroleum and coal products industry in Arkansas, and considerably more than the Arkansas mining industry. Cumulatively, between 1977 and 1991, telecommunications modernization generated over 67,000 person-years of employment.

Eighty percent of the increase in jobs occurred in the relatively stable, high-growth non manufacturing sector. These employment gains helped to insulate the state from the recessions of 1980-82. The state's economy would have lost 7.8% more jobs than it did during the 1980-82 recession. *Table III-2-1* contains a summary of 1991 employment gains generated by increased efficiency due to advances in telecommunications technology since 1977.

Table III-2-1

***Increases in Employment in Arkansas
Due to Telecommunications-Induced Efficiency Gains Since 1977
(Thousands of Person-Years)***

	Cumulative Gain 1977-91	Average Gain per Year 1977-91	1991 Gain	1991 Percent Gain
Employment	67.2	4.80	10.8	1.2 %

Source: DRI/McGraw-Hill

Personal Income

Arkansas residents also benefited from increased personal income stemming from higher employment levels and higher real wages. DRI found that economic expansion resulting from lower production costs generated an average of about \$26 million a year in nominal personal income between 1977 and 1991. By 1991, Arkansas residents earned almost \$89 million more than they could have under the 1977 infrastructure, a cumulative \$361 million increase in nominal income.

Taking into account the fact that telecommunications-induced efficiency gains in all segments of the Arkansas economy combined to lower the CPI by 1.4% in 1991, it becomes clear that the increase in purchasing power throughout the state was far greater than the dollar figures of income gain reported in the first row of *Table III-2-2* below. The \$89 million increase in 1991 income was actually associated with an increase in purchasing power equivalent to nearly \$570 million because prices of Arkansas-produced goods and services were lower than they would have been without modern telecommunications technology.¹⁷

Table III-2-2
Increases in Personal Income in Arkansas
Due to Telecommunications-Induced Efficiency Gains Since 1977
(Billions of Dollars)

	Cumulative Gain 1977-91	Average Gain per Year 1977-91	1991 Gain	1991 Percent Gain
Personal income	0.361	0.026	0.089	0.3 %
Actual purchasing power of additional personal income*	3.700	0.260	0.570	1.7 %

* Purchasing power figures exceed personal income and tax revenue figures because increased telecommunications consumption lowered the price of Arkansas-produced goods and services. Hence, each dollar of personal income and tax revenue bought more than it would have without advanced telecommunications technology. Purchasing power is presented in 1991\$.

These results have important implications for individual Arkansas households and employees. DRI finds that in 1991, the average Arkansas household experienced a telecommunications-induced increase in purchasing power equivalent to earning an extra \$274. On average, from 1977 to 1991, a Arkansas household gained the equivalent of an additional \$144 per year (in 1991 dollars) of purchasing power due to telecommunications advances since 1977. These results are summarized in *Table III-2-3* below.

¹⁷ Note that it is difficult to directly compare the change in nominal income with the change in real purchasing power. The change in nominal income reflects two countervailing effects of telecommunications induced efficiency gains. The increase in employment associated with efficiency tends to boost income growth, while the decrease in inflation tends to limit the growth in wages and, consequently, nominal income. The change in the purchasing power reflects the fact that consumers can purchase more goods and services due to both higher employment and the fact that the price of consumer goods decline relative to wages. Moreover, a change in the price of consumer goods affects the purchasing power of all personal income—not just the additional nominal income. As a result, the nominal gains in personal income are small relative to the increase in purchasing power.

Table III-2-3

**Increases in Income in Arkansas
Due to Telecommunications-Induced Efficiency Gains Since 1977
(1991 Dollars)**

	Average Gain per Year 1977-91	1991 Gain
Average household income	144	274

Source: DRI/McGraw-Hill

Tax Revenue

Income from the additional jobs associated with telecommunications-induced efficiency gains spurred additional spending throughout the economy. This in turn boosted wholesale and retail trade activity. Greater retail and wholesale activity increased sales tax revenues for the state, while higher incomes supported income tax revenues. Together, these effects translated into an average of \$2.4 million a year in nominal state and local tax revenues, ranging up to \$8.1 million in 1991. Cumulatively, this represented more than a \$32.9 million dollars in additional nominal state and local tax revenues generated by the higher level of economic activity over this period (Table III-2-4).

Table III-2-4

**Increases in Tax Revenue in Arkansas
Due to Telecommunications-Induced Efficiency Gains Since 1977
(Millions of Dollars)**

	Cumulative Gain 1977-91	Average Gain per Year 1977-91	1991 Gain	1991 Percent Gain
Tax Revenue	32.9	2.35	8.14	0.26%
Actual purchasing power of additional tax revenue*	331.6	23.69	51.84	1.66%

* Purchasing power figures exceed personal income and tax revenue figures because increased telecommunications consumption lowered the price of Arkansas-produced goods and services. Hence, each dollar of personal income and tax revenue bought more than it would have without advanced telecommunications technology. Purchasing power is presented in 1991\$.

The actual purchasing power associated with these tax revenue gains is far greater than the dollar figures presented in Table III-2-4 because efficiency gains stemming from telecommunications modernization made the entire Arkansas economy more cost-competitive and, therefore, lowered CPI. Taking these lower costs into account, the \$8.1 million increase in 1991 tax revenue was associated with an increase in purchasing power that is the equivalent of an additional \$51.8 million in 1991 tax revenue. The average gain

in tax revenue of \$2.35 million per year was associated with an increase in purchasing power equivalent to an additional \$23.7 million in tax revenue per year (in 1991 dollars).

III-3. Network Design, Construction and Maintenance Related Gains

Employment

The physical process of designing, building, and maintaining telecommunications infrastructure since 1977 also supported a substantial number of new jobs in Arkansas. These jobs were in industries supplying building materials and services to the network construction and maintenance, in industries that supply the suppliers, and in other industries that enjoy greater demand because of higher employment and income throughout Arkansas. Taking all of these sources of demand into account, DRI estimates that activity related to Southwestern Bell's telecommunications infrastructure design, construction, and maintenance supported an average of 3,700 jobs per year between 1977 and 1991. Cumulatively, Southwestern Bell investments supported about 55,400 person-years of employment from 1977 to 1991 (Table III-3-1). The employment which is sustained by design, construction, and maintenance is in addition to the jobs generated by telecommunications-induced efficiency gains.

Table III-3-1

Employment

*Supported by Network Design, Construction, and Maintenance Since 1977
(Thousands of Person-Years)*

	Cumulative Gain 1977-91	Average Gain per Year 1977-91
Employment	55.4	3.69

Personal Income

As in the case of employment, the actual process of designing, constructing, and maintaining the new network supported further increases in income. DRI estimates that Arkansas residents enjoyed an average of \$86 million more per year than they could have had the network not been enhanced but merely maintained since 1977 (Table III-3-2). This represents income supported above and beyond the \$260 million a year increase in purchasing power resulting from telecommunications-induced efficiency gains throughout Arkansas industries. However, economic activity associated with network design, construction, and maintenance does not increase efficiency gains and it therefore creates no associated increase in purchasing power of personal income. The fact that this additional income does not increase efficiency means that there is no related decrease in prices; hence, there is no corresponding increase purchasing power from the additional personal income.

Table III-3-2**Personal Income**

Supported by Network Design, Construction, and Maintenance Since 1977
(Millions of 1991 Dollars)

	Cumulative Gain 1977-91	Average Gain per Year 1977-91
Personal Income	1,290	86

Tax Revenue

Similarly, the design, construction, and maintenance of Arkansas's telecommunications network supported cumulative tax revenues of \$112 billion over the 1977-91 period (*Table III-3-3*). This figure is above the gain in tax revenue due to telecommunications-induced efficiency. Again, it creates no associated increase in purchasing power of tax revenue because economic activity associated with network design, construction, and maintenance does not increase efficiency gains. Therefore, there is no related decrease in prices, so there is no corresponding increase purchasing power from the additional tax revenue.

Table III-3-3**Tax Revenue**

Supported by Network Design, Construction, and Maintenance Since 1977
(Millions of 1991 Dollars)

	Cumulative Gain 1977-91	Average Gain per Year 1977-91
Tax Revenue	112	7.5

III-4. FINDINGS AND OBSERVATIONS

The historical private infrastructure investment pursued by the telecommunications sector has resulted in identifiable and measurable impacts on the Arkansas economy. Specifically, network modernization increased telecommunications production efficiencies, lowered telecommunications service prices, increased end-user productivity and positively impacted the state's competitive position. This translates into additional jobs, income, and tax revenues for the state. Key findings include:

- Over the 1977-1991 time period, efficiency gains resulting from telecommunications infrastructure modernization and increased usage in Arkansas since 1977 generated, on average, 4,800 jobs per year in the state economy.
- The productivity enhancements associated with telecommunications infrastructure modernization generated a cumulative total of \$361 million in nominal personal income between 1977 and 1991 (an average of about \$26 million per year), as well as \$32.9 million in state and local tax revenue between 1977 and 1991.
- The CPI was 1.4% lower as a result of telecommunications-induced efficiency gains, indicating that a dollar bought more goods and services in Arkansas in 1991 than it could have without post-1977 infrastructure modernization.
- On average, from 1977 to 1991, the average Arkansas household experienced the equivalent of an additional \$144 in income per year due to the telecommunications advances since 1977 (in 1991 dollars).
- Arkansas's economy would have shed an additional 2,300 jobs during the 1980-82 recession had telecommunications not advanced from 1977 technology.

IV. FUTURE TELECOMMUNICATIONS NETWORK MODERNIZATION AND THE ECONOMIC PERFORMANCE OF ARKANSAS

Having established the historical contribution of telecommunications to economic growth in Arkansas in Section III, this section investigates the impact of accelerating the deployment of advanced telecommunications in the future as defined by the Stipulation which proposes that the Company invest approximately \$231 million in the network by the end of 1996. Hence, this section investigates the economic consequences of making the additional investment to modernize the network.

Two scenarios are investigated: (1) one in which the Stipulation is adopted, additional investment is made to modernize the network, and rates for certain services decline--the "Accelerated Deployment Scenario", and (2) one in which the Stipulation is not adopted and the revenue requirement effect of this additional investment is returned to the rate payer the "Limited Deployment Scenario".

The future benefits of network modernization to the Arkansas economy can be segmented into two effects. The first effect focuses on the contribution of network construction activities to the Arkansas economy and is called the "construction effect." To estimate this effect, the employment, income, and taxes that are supported by construction activities associated with Southwestern Bell's network modernization plan are determined.

The second effect relates to the impact of telecommunications usage on the Arkansas economy--the "efficiency effect". Unlike the construction effect that quantifies the impact of network construction activities, the efficiency effect measures the more critical issues of productivity and competitiveness. Specifically, the change in Arkansas employment, income, and taxes generated between 1993 and 2002 by an increase in state-wide economic activity due to network-induced economy-wide production efficiencies is estimated in this effect.

An Overview of the Outlook of the Arkansas Economy

The figures reported here are based on a DRI forecast of economic growth in Arkansas. The forecast is developed by regional economists at DRI/McGraw-Hill as part of on-going services delivered to our clients in business and government.

As *Table IV* shows, the Arkansas economy outperformed the nation and performed comparably to the West South Central region between 1977 and 1991. President Clinton's home state will continue to prosper in the coming years, although growth in total employment will fall slightly short of historical growth, with employment rising only 2.2% through 1995. Its long-term performance of 1.6% compound annual growth through 2002 will be slightly weaker than the nation's 1.7%.

Table IV

Total Nonfarm Employment Growth: West South Central Region

	Compound Annual Growth 1977-91	Compound Annual Growth 1993-2002
Arkansas	2.2%	1.6%
Louisiana	1.2%	1.6%
Oklahoma	1.6%	1.6%
Texas	2.8%	1.9%
West South Central	2.3%	1.8%
National Total	1.9%	1.7%

Source: DRI/McGraw-Hill Regional Information Service

Arkansas is one of only three states in the nation to have added manufacturing jobs over the past two years. Driving this historical growth was the state's low cost structure and aggressive recruiting efforts aimed at luring manufacturers into the state. Through the end of 1994 however, a manufacturing employment growth rate of 1.3% lags both the 3.5% average annual rate for the non manufacturing sectors and an overall employment growth rate of 3.0%. The strong non manufacturing growth rate is being led by an average annual growth rate of 4.4% in the service sector. This far exceeds the national rate of 2.3% for the same period. The fact that the service employment growth rate is growing faster than the overall state employment growth rate implies that a larger share of the jobs in Arkansas are being created in service industries. In fact, by 1997, the service sector will surpass the manufacturing sector as the largest industry in Arkansas as measured by the number of employees.

IV-1. SCENARIO ONE: THE ACCELERATED DEPLOYMENT SCENARIO

In the Accelerated Deployment scenario, we assume that the Stipulation is adopted, additional investment is made to modernize the network, and rates for certain services decline. There are two effects associated with the Accelerated Deployment scenario—the "construction effect" and the "efficiency effect".

The Contribution of the Stipulation on the Arkansas Economy: The Construction Effect

The total economic benefit of modernizing the telecommunications network in Arkansas will exceed the direct investment in new telecommunications facilities. The construction activity associated with network development spurs growth in sectors on which the telecommunications industry relies for inputs. As these sectors expand, they employ more people; increase the income of their employees and shareholders; and generally lead to a more robust economy. Hence, the total economic benefit of modernizing the telecommunications network in Arkansas will exceed the direct investment in new telecommunications facilities. Moreover, a portion of the funds used for network modernization are returned to the rate payer indirectly, through the direct and indirect impact of network related construction activity. Using the *DRI Interindustry Model* and the *DRI Arkansas State Economic Model*, we are able to estimate these spillover effects of the investment scenario.

Roughly 21 % of the expenditures will be on wages and salaries, providing a direct boost to the Arkansas economy. By contrast, the expenditures on other material inputs have a lesser impact on the Arkansas economy, because these goods will often be produced out of state. *Table IV-1-1* below shows the contribution of these expenditures to key measures of state economic performance in this scenario.

Table IV-1-1

***Increase in Economic Activity in Arkansas Generated by
Telecommunications-Related Construction from 1993 through 2002***

	Cumulative Gain	Average Gain per Year	2002 Gain	2002 Percent Gain
Employment	4.00	0.45	---	---
Personal Income	115	13	---	---
Tax Revenue	11.07	1.23	---	---

Employment is reported in thousands of jobs; income and taxes are reported in millions of 1991\$. Cumulative employment gain is reported in person-years.

The initial stimulus for the economic expansion is the increased labor associated with the construction and maintenance of new telecommunications facilities. Labor represents

approximately 21% of the total \$231 million in expenditures on network development in the Stipulation and includes the labor associated with installing new equipment as well as the labor used as maintenance for one year after installation. The figures do not include the employees of telecommunications equipment manufacturers who often perform the installation of new equipment. Because these persons do not necessarily reside in Arkansas, it would be inappropriate to include their income and spending in our Arkansas analysis.

As construction activity progresses, it requires more inputs from supplying industries, and industries that manufacture telecommunications equipment, conduit, OSP equipment, and other miscellaneous goods and services. The increased demand in these sectors further spurs economic growth as these sectors require inputs from their supplying sectors, and so on. As discussed in Section IV-1, this interindustry multiplier effect is measured using the DRI Industry Model.

Before running the Arkansas State Economic Model to measure the impact of these new jobs on income, taxes, and income-related job growth, DRI made an assumption regarding the degree to which these demand increases are likely to be met within the state. The analysis assumes that the amount of goods purchased from vendors in Arkansas is equivalent to the size of each industry in Arkansas relative to the size of the national industry. The only exception to this is the service sector where DRI assumes that 50% of the demand for services is met in-state. Under this assumption, we then used the Arkansas State Model to obtain the multiplier effect, the mechanism by which increased demand for labor leads to more jobs, higher wages, more discretionary income, more consumer spending, more production to support sales to consumers, higher employment to support the increased production, and so on.

Employment

The physical process of designing, building, and maintaining the enhancements to the telecommunications infrastructure proposed by the Stipulation will support a substantial number of new jobs in Arkansas. These employment gains include jobs in the telecommunications industry itself, in industries supplying building materials and services to the network construction and maintenance, in industries that supply the suppliers, and in other industries that enjoy greater demand because of higher employment and income throughout Arkansas. Taking all of these sources of demand into account, DRI estimates that activity related to the \$231 million infrastructure commitment will support an average of 450 jobs per year from 1993 through 2002. Cumulatively, this represents about 4,000 person-years of employment from 1993 to 2002 (*Table IV-1-2*). Note that since the infrastructure enhancements proposed by the Stipulation will be made over the 1994 to 1996 period, the great majority of the new jobs will be created over this period. Thus although our figures represent impacts over the 1993 to 2002 period (to be consistent with the time period analyzed in the efficiency effect), the impacts reflect only the effect of the \$231 millions spent over the 1994 to 1996.

Personal Income

DRI finds that the construction-related effects of Southwestern Bell's modernization plan can support an average increase in personal income of about \$13 million a year from 1993 through 2002. This is a cumulative gain of \$115 million over the entire 1993-2002 interval (*Table IV-1-2*). Gains are slight because there are no efficiency gains and therefore no corresponding change in the CPI.

Tax Revenue

Scenario One will also support a cumulative tax revenue gain of \$11 million over the 1993-2002 period (*Table IV-1-2*).

Although the construction effect associated with the Stipulation is significant and important, a somewhat similar effect could be achieved with highway construction or water and sewer maintenance. Different multipliers are associated with different types of construction activity, but the effects are similar. The more important aspect of telecommunications modernization and what distinguishes it from some other types of investment programs is its ability to promote efficiency, lower costs, improved competitiveness, and sustainable economic growth. These factors will be addressed in the following section.

The Contribution of the Stipulation on the Arkansas Economy: The Efficiency Effect

The Accelerated Deployment scenario reflects the effects on the Arkansas economy of the faster growth in telecommunications usage associated with the Stipulation. The assumption of higher usage in this scenario reflects both the rate reduction associated with the Stipulation plan and the technology advancements promised from additional investments in the state's telecommunications infrastructure. Previous DRI research shows that usage is closely associated with prices and technology. When telecommunications prices fall, telecommunications usage increases. When technology advances, the quality, reliability, and functionality of telecommunications services will increase. And, as the functionality of the telecommunications network improves, usage will, in turn, increase. As a result of these assumptions, telecommunications usage in the accelerated deployment scenario was projected to grow 4.0% a year over the entire interval 1993 to 2002.

As previously discussed, DRI research reveals that the benefits of a modern telecommunications network will follow two paths in this scenario: 1) those generated by the physical construction of the network and 2) those generated by telecommunications-related gains in efficiency. Again, the important aspect of telecommunications modernization is that it promotes efficiency gains and sustainable economic growth, as described below. There are two efficiency gains associated with telecommunications modernization:

- **Efficiency gains in the production of telecommunications.** The telecommunications industry improves its own productivity by spending less on inputs from other industries while producing the same or higher level of output. This improved productivity frees resources for other productive uses and thereby makes the entire economy more efficient.
- **Efficiency gains induced by the usage of telecommunications.** End users also benefit from modernization because modernization of the telecommunications network improves the quality, reliability, and relative price of telecommunications. Industries respond by increasing their usage of telecommunications in their own production processes. As this occurs, industries are able to reduce their need for more costly, less efficient inputs which will then further contribute to a more efficient Arkansas economy.

It should be noted that many of the benefits of telecommunications network modernization will occur beyond 2002 after firms have had time to assimilate the advanced technologies. Hence, the infrastructure investments made during the 1990s will be felt long after the end of the decade.

It should also be noted that these results are extremely conservative estimates of the impact of telecommunications modernization on the Arkansas economy:

- (1) This analysis is based on the Commerce Department's payroll survey employment estimates which do not include self-employed doctors, consultants, and lawyers. Since these workers tend to rely heavily on information and telecommunications needs, our results may understate the impact of telecommunications modernization on jobs in the region.
- (2) The leakage assumptions may understate the total impact of telecommunications modernization on the Arkansas economy.
- (3) These usage assumptions are also conservative. There is reason to believe that future telecommunications usage will rise at a faster rate than that assumed in this analysis. Recent surveys have shown that telecommunications budgets for large corporations are growing faster than the historic rate.¹⁸ Unlike small business, large corporations have the financial capital to acquire the requisite hardware and software.

¹⁸ Barry Harbaugh and Brent McMahan, "Telecommunications Takes Center Stage," *Area Development*, April 1992, page 26.

Table IV-1-2

**Increase in Economic Activity in Arkansas Generated by
Telecommunications-Induced Efficiency Gains from 1993 through 2002
-- Accelerated Deployment Scenario Relative to Limited Deployment Scenario --**

	Cumulative Gain	Average Gain per Year	2002 Gain	2002 Percent Gain
Employment	9.41	1.05	2.64	0.23 %
Personal Income	478	53	117	0.27 %
Tax Revenue	46.30	5.15	11.29	0.27 %

Employment is reported in thousands of jobs; income and taxes are reported in millions of 1991\$. Cumulative employment gain is in person-years.

Employment

Table IV-1-2 shows the employment impacts associated with increased efficiency due to accelerated usage of telecommunications in Arkansas from 1993 through 2002. Reductions in Arkansas business costs due to higher usage from 1993 through 2002 will create a more cost-competitive economy, able to support an average increase of 1,050 jobs per year relative to the Limited Deployment Scenario (*Table IV-1-2*). Cumulatively, from 1993 through 2002, accelerated telecommunications network modernization could generate an additional 9,410 person-years of employment. These efficiency-induced job gains are in addition to the construction-related job gains described in Chapter IV-1. Moreover, they are incremental to the job gains reported under the Limited Deployment Scenario. As described in Chapter IV-3, the Limited Deployment Scenario would support 23,900 person-years of employment. We estimate that the Accelerated Deployment Scenario would generate *an additional* 9,400 person-years of employment, for a total of 33,300 person-years. The personal income and tax revenue figures below are also incremental to those described in Chapter IV-3.

Personal Income

Arkansas residents will also realize a gain in personal income due to increased employment and higher real wages. DRI finds that lower production costs can support an average increase in personal income of about \$53 million a year relative to the Limited Deployment scenario over the period 1993 through 2002. By 2002, real personal income will be approximately \$117 million higher than it is in the Limited Deployment scenario. This is a cumulative gain of \$478 million. (These figures are reported in 1991 dollars.)

These income gains arise primarily from the fact that higher levels of telecommunications consumption lead to production cost savings that can be passed on to consumers in the form of lower prices. In other words, a dollar would be able to buy more Arkansas

products under the accelerated usage scenario than it would under the Limited Deployment scenario. Since all dollar figures are constant 1991 dollars, they represent the *value* of that income in terms of the prices of consumer goods and services that prevailed in 1991. Hence, these measures remove the effects of inflation. Thus, the 1991-dollar personal income increases represent the telecommunications-induced increase in purchasing power, or the increase in the amount of Arkansas-produced goods and services that statewide income could buy, if 1991 prices still prevailed.

Tax Revenues

Income from the additional jobs and real wages associated with Accelerated Deployment scenario will increase spending throughout the economy which, in turn, will increase sales tax revenues, while higher incomes will create higher income tax revenues. Together, over the 1993 to 2002 interval, these effects translate into an average annual \$5.2 million in additional state and local tax revenues and into as much as \$11.3 million in 2002 relative to the Limited Deployment scenario. Cumulatively, this represents tax collections that are \$46.3 million higher than the Limited Deployment scenario. As in the case of personal income, these tax revenue increases are reported in 1991 dollars. They therefore reflect the actual purchasing power of this revenue if 1991 prices still prevailed.

Consumer Price Index (CPI)

Under the accelerated usage scenario, Arkansas industries achieve substantial cost savings by substituting greater amounts of telecommunications services in place of less efficient inputs. These cost savings would be passed on to customer industries, and, finally, to end users. The resulting Consumer Price Index (CPI) would be 0.2% lower in 2002 than in the Limited Deployment scenario. In addition, society at large benefits from an advanced telecommunications network as information flows improve for the health, education, and public safety sectors. These benefits are not reflected in the figures presented in *Table IV-1-2*.

IV-2. SCENARIO TWO: THE LIMITED DEPLOYMENT SCENARIO

Scenario Two is the Limited Deployment Scenario. In this scenario, we assume that the Stipulation is not adopted and the revenue requirement effect of this additional investment is returned to the rate payer. As a result, there is no "construction effect" in this scenario. Instead, there is the effect of a direct increase in personal income. This scenario also represents a situation in which Southwestern Bell does not accelerate its modernization plans for the public network; hence, the degree of modernization in the Limited Deployment scenario is necessarily less than in Accelerated Deployment scenario. As a result, growth in telecommunications usage is constrained.

The Contribution of the Limited Deployment Scenario on the Arkansas Economy: The Efficiency Effect

The limited deployment scenario reflects an economy in which telecommunications usage grows at a 2.6% compound annual growth rate over the 1993 to 2002 interval. Under this scenario, industries are less able to utilize new telecommunications services as an efficient replacement for other inputs and would therefore fail to achieve the cost savings possible under the Accelerated Deployment assumptions. However, the moderate 2.6% growth in usage still provides benefits to the economy relative to a scenario in which telecommunications usage does not grow at all. The figures presented here represent the contribution of this 2.6% growth in usage relative to a 0% usage growth scenario. (It should be noted that the job gains reported under the Accelerated Deployment Scenario are over and above those reported here. That is, the Accelerated Deployment Scenario will generate the 23,900 person-years of employment reported for the Limited Deployment Scenario, plus an additional 9,400 person-years of employment.)

Our assumption that telecommunications usage will increase (as opposed to decreasing or remaining constant) in the Limited Deployment Scenario is based on three observations:

- Competition in the market for high-end, advanced telecommunications has resulted in less reliance on the public switched network, especially for large businesses. Large firms that can afford to install private networks will continue to do so and will continue to benefit from the efficiency associated with increased telecommunications usage.
- Advances in customer premises equipment (CPE) will continue to expand the versatility of the existing public network, although clearly at a much slower rate than would be possible with a more modern network.
- Some network modernization will still take place. Southwestern Bell does not cease all modernization in this scenario, although they are forced to slow the pace of modernization.

Table IV-2-1

**Increase in Economic Activity in Arkansas Caused by
Telecommunications-Related Efficiency Gains from 1993 through 2002
-- Limited Deployment Scenario Relative to A No-Deployment Scenario --**

	Cumulative Increase	Average Increase per Year	2002 Increase	2002 Percent Increase
Employment	23.90	2.66	6.10	0.54%
Personal Income	1,270	141	306	0.72%
Tax Revenue	123	13.7	29.6	0.72%

Employment is reported in thousands of jobs; income and taxes are reported in millions of 1991\$. Cumulative employment decrease is reported in person-years.

Employment

Table IV-2-1 summarizes the employment impacts associated with a Limited Deployment scenario. In this scenario, Arkansas is able to support an average of nearly 2,660 more jobs per year relative to a base case scenario where telecommunications growth is flat. By 2002 the Arkansas economy will be able to support nearly 6,100 more employees than in the base case (*Table IV-2-1*). Cumulatively, from 1993 through 2002, telecommunications network modernization may generate 23,900 more person-years of employment.

Personal Income

Arkansas residents will also realize a gain in personal income compared to the base case. Personal income increases by an average of about \$141 million a year from 1993 through 2002 relative to the base case. By 2002, real personal income will be approximately \$306 million higher than it is in the base case scenario. This is a cumulative gain of \$1.3 billion (*Table IV-2-1*).

Tax Revenue

Faster income growth boosts spending throughout the economy which, in turn, increases sales tax revenues, while higher incomes creates additional income tax revenues. Together, over the 1993 to 2002 interval, these effects translate into an average annual \$13.7 million increase in state and local tax revenues and into a gain as high as \$29.6 million in 2002 relative to the base case, or no growth, scenario. Cumulatively, this represents tax collections that are \$123 million higher than the base case scenario (*Table IV-2-1*).

Consumer Price Index (CPI)

Under the limited usage scenario, Arkansas industries can achieve substantial cost savings by substituting greater amounts of telecommunications services in place of less efficient inputs. The resulting Consumer Price Index (CPI) would be 0.6% lower than under the base case.

**The Effect of the Returning the Revenue Requirement Effect of the Company's
Additional Investment to the Rate payer**

In this section, we assess the effect of returning to the rate payer the revenue requirement impact of the Company's \$231 million infrastructure commitment contained in the Stipulation. That is we assume that the Stipulation does not pass and instead of using the \$231 million on infrastructure enhancements, the Company returns funds to the rate payers. (This scenario was developed by DRI to illustrate the impact of alternative uses of network modernization funds. It does not necessarily reflect the plans of the Company.) Specifically, this translates into boosting the after-tax disposable income variable in the Arkansas State model by an additional \$19.3 million each year for the period 1994 to 2003. This \$19.3 million represents the revenue requirement impact of the \$231 million in new investments proposed in the Stipulation. (See the testimony of Keith Mittedorf for a description of the calculation of the revenue requirements impact.)

The additional direct income boost to Arkansas residents will create a ripple effect through the economy as residents spend these funds on Arkansas produced goods and services. These additional funds will generate approximately 3,400 person-years of employment over the 1993 to 2002 period. Most of these jobs will be in the personal service and retail trade sectors as these sectors are primarily driven by Arkansas disposable income (Table IV-2-2). These additional jobs will, in turn, create additional income and tax revenues for the state.

This compares poorly with the "construction effect" associated with the Accelerated Deployment scenario which generated 4,000 person-years of employment. Hence, the analysis reveals that Arkansas residents are better served when Southwestern Bell invests the funds in network modernization, even before the efficiency gains engendered by the more modern network are taken into account.

Table IV-2-2

***Increase in Economic Activity in Arkansas Caused by
Returning to the Rate payer the Revenue Requirement
Effect of the Company's Additional Investment***

	Cumulative Increase	Average Increase per Year	2002 Increase	2002 Percent Increase
Employment	3.4	0.4	0.4	0.03
Personal Income¹⁹	92.0	10.2	12.0	0.03
Tax Revenue	8.9	0.9	1.1	0.03

Employment is reported in thousands of jobs; income and taxes are reported in millions of 1991\$. Cumulative employment increase is reported in person-years.

¹⁹ Note that the average gain in personal income (\$10.2 million) is less than the \$19.3 million refunded to rate payers. This is due to the technical definition of personal income as the sum of various income categories (e.g., wage and salary, farm, and rental income, etc.). The personal income numbers therefore represent the incremental income generated as a result of the refund. Total real disposable income for consumer would increase by \$19.3 million (deflated to 1991 dollars) plus the \$10.2 million reported above.

IV-3. FINDINGS AND OBSERVATIONS

As over history, infrastructure investment pursued by the telecommunications sector in the future will result in identifiable and measurable impacts. An understanding of the relationship between telecommunications infrastructure modernization and the future performance of Arkansas is crucial to strategic decision-making about the industry. Key findings of the analysis covered in Chapter IV include:

- The Arkansas economy outperformed the nation and performed comparably to the West South Central region as a whole between 1977 and 1991. Growth in total employment will fall slightly short of historical growth, with employment rising only 2.2% through 1995. Its long-term performance of 1.6% compound annual growth through 2002 will be slightly weaker than the nation's 1.7%.
- Manufacturing has been one of Arkansas's strongest sectors. Over the past two years, only three other states added manufacturing jobs. Through the end of 1994, the manufacturing sector will grow at an annual rate of 1.5%. Propelling the industry is the state's low cost structure and aggressive recruiting efforts aimed at luring manufacturers into the state.
- In the Accelerated Deployment scenario, where the usage of telecommunications advances at a 4.0% annual rate through 2002, the economy grows by a total of 33,300 person-years of employment. This is 9,400 person-years more than the job gain estimated due to telecommunications usage in the Limited Deployment scenario. These additional jobs will translate into \$480 million in additional personal income for Arkansas residents, and \$46 million in state and local tax revenues through 2002.
- In the Limited Deployment Scenario, overall telecommunications usage continues to grow at the historical rate of 2.0% per year over the 1993 to 2013 interval, but it grows more slowly over the first 10 years than in the Accelerated Deployment scenario. The efficiency induced by telecommunications usage in this scenario will allow employment to expand by 24,000 person-years over the 1993 to 2002 period. Both personal income and state and local tax revenues will also increase.
- Returning the revenue requirement of the Company's additional investment to the rate payer would generate approximately 3,400 person-years of employment over the 1993 to 2002 period. Most of these jobs will be in the personal service and retail trade sectors as these sectors are primarily driven by Arkansas disposable income. This is less than the "construction effect" associated with the Accelerated Deployment scenario which generated 4,000 person-years of employment.

V. **IMPACT OF TELECOMMUNICATIONS ADVANCES ON HEALTH CARE AND EDUCATION COSTS IN ARKANSAS**

V-1. **INTRODUCTION**

In this section we detail the extent to which telecommunications advances since 1963 have contributed to cost savings in the health care services and educational services sectors in Arkansas.

While varying in the degree to which they are supported by government expenditures, the health care and educational services sectors are more directly perceived as related to public welfare than other sectors and as such have received increasingly focused public attention. While several policy- and technology-based options have been examined, testimony presented at recent congressional hearings²⁰ attests to the immense potential for telecommunications services, in particular, to at once *broaden the availability and quality* of health care and educational services and *moderate the costs* of those services.

Medical specialists uniformly have extolled telecommunications' role in allowing doctors to provide better and better service. Advanced fiber optic networks not only facilitate the dissemination of medical tests, records, research data, and findings, but in particular, facilitate the transfer of patient information involving medical imaging technologies. Health care providers emphasize the need to ensure that these and other telecommunications innovations, continue to be exploited in the provision of health care services as a relatively low-cost means of improving quality and access. As summarized by J. Michael McGinnis, M.D., Deputy Assistant Secretary for Health,

*"As we look for ways to improve our effectiveness in reaching the public and health professionals alike with timely, relevant, and accessible health information, we look to new communication technologies not to solve our problems, but to provide us with the opportunity to develop new, creative solutions to improving the public health."*²¹

Similarly, educators and education policy makers stress the importance of integrating telecommunications services in the educational process as a way to accomplish three related policy goals: to augment the quality of the educational system through implementation of innovative telecommunications applications; to increase quality while controlling costs; and to ensure equitable access to improved educational opportunities via telecommunications-based innovations. Representative Edward J. Markey, Chairman of the House Subcommittee on Telecommunications and Finance, summarized these issues in opening remarks before the full Committee:

²⁰ Hearings conducted before the U.S. House of Representatives Committee on Energy and Commerce, Subcommittee on Telecommunications and Finance, 19 January to 31 March 1993.

²¹ Testimony presented by J. Michael McGinnis, M.D., Public Health Service, U.S. Department of Health and Human Services, 23 February 1993, before the House Subcommittee on Telecommunications and Finance.

"The need for change in our education system is evident: massive illiteracy, low SAT scores, and an acute shortage of teachers in rural areas all indicate we must act now to improve our methods of educating America's youth and adults... An infrastructure with education applications--such as virtual laboratories and collaborative learning--can extend many communications technologies to all Americans and empower them to succeed in today's Information Age."

To estimate the cost savings made possible by telecommunications advances to these two sectors, DRI constructed a "translog" econometric model of health care costs covering doctor and dentist services, hospitals, nursing and personal care, and other medical services, and a translog model of educational costs covering state and local government expenditures on education plus private expenditures made by educational providers. The models assumed that health care providers and educational services providers are rational economic agents, choosing a mix of inputs that minimizes the cost of achieving a given output level. (Details concerning translog cost models and their properties are available in Section IV.)

Once the translog cost equation and associated input share equations were statistically determined, a simulation was conducted in which health service providers, and educational services providers, in every year from 1977 to 1991 were constrained to confront the telecommunications relative prices and level of technology that held in 1977. DRI used this result to calculate the percentage by which per-unit input costs would have increased in the absence of a modern telecommunications infrastructure. These percent cost savings were then applied to actual historical expenditures on health care and education services in Arkansas from 1977 to 1991, yielding the actual dollar amount that Arkansas health care providers and educational institutions saved in input costs because of telecommunications advances. DRI's research findings are summarized in Table V-3-1, which follows the discussion of cost savings in each sector below.

V-2. TELECOMMUNICATIONS AND HEALTH CARE COST SAVINGS IN ARKANSAS

Data on health care expenditures were drawn from the American Hospital Associations Hospital Statistics, an annual publication detailing state-specific hospital operating statistics. Total expenses for all AHA registered Arkansas hospitals reached \$2.12 billion in 1991. While Arkansas-specific doctor and dentist, nursing, and other medical service expenses are not available, by applying the national-level ratio of hospital expenses to total health care expenses, DRI calculates that total 1991 health care expenses reached \$4.72 billion. Assuming that telecommunications reduced health care costs in Arkansas in the same proportion as cost reductions to total U.S. health care, advances in telecommunications production and consumption reduced 1991 Arkansas health care costs by about \$32.8 million. The cumulative savings enjoyed by the Arkansas economy over the entire 1977 to 1991 interval, displayed in Table V-3-1, totaled \$233 million in 1991 dollars.